### 19.2.1 Synchronous Optical Network Or Digital Hierarchy (SONET/SDH)

SONET and the associated TDM hierarchy were originally designed as a system to carry digital voice telephone calls. The technology has become the standard for the digital circuits used throughout the Internet. SONET permits a physical ring to be constructed with the purpose of providing redundancy. The hardware can automatically detect and correct problems — even if one part of the ring is damaged, data can still get through. A device known as an *Add-Drop Multiplexor* is used to connect a site to a SONET ring. The term arises because the Add-Drop Multiplexor either inserts or terminates a set of data circuits that each connect to another Add-Drop Multiplexor on the ring. SONET uses time division multiplexing to multiplex the circuits onto the underlying fiber. SDH provides the well-known standards for circuits such as a T3 circuit that can be configured across a SONET ring.

### 19.2.2 Optical Carrier (OC) Circuits

The OC standards specify the signaling used on an optical fiber SONET ring. OC standards are associated with higher data rates than the T-series standards provided by SDH. A private company might choose to lease an OC circuit to connect two of the company sites. Tier 1 ISPs use circuits of OC-192 (10 Mbps) and OC-768 (40 Mbps) in the backbone of the Internet.

### 19.2.3 Digital Subscriber Line (DSL) And Cable Modems

These two technologies currently offer the principal means of providing broadband Internet access to private residences and small businesses. DSL makes use of existing telephone land lines, and cable modem technology makes use of existing cable television infrastructure. DSL offers data rates of 1 to 6 Mbps, depending on the distance between a central office and a subscriber; cable modems offer up to 52 Mbps, but the bandwidth is shared among a set of users. Both technologies are viewed as transitory until optical fiber is available to the curb or to the home.

### 19.2.4 Wi-Fi And WiMAX

Wi-Fi comprises a set of wireless technologies that have become widely used to provide Internet access in homes, cafes, airports, hotels, and other locations. Successive generations of Wi-Fi technologies have increased overall data rates.

WiMAX is an emerging wireless technology that can be used to form a MAN. WiMAX provides either access or backhaul† capabilities, and two versions are defined to support fixed and mobile endpoints.

†Backhaul comprises the connections from a remote location or access point back to a provider's central facility.